Summary of Lower Salinas River/Elkhorn Slough TMDLs for Pesticides and Priority Organics

SCHEDULE
Draft Project Report by early 2009.
Final Project Report posted for public comment prior to Board Hearing.
Board Hearing to be determined; anticipate late 2009.

Listing Basis
Waterbodies were listed in 1994 (1996 for Blanco Drain) based on data from three state programs; State Mussel Watch (SMW), Toxic Substances Monitoring (TSM), and Bay Protection and Toxic Cleanup Program (BPTCP).

Compounds and Waterbodies Addressed
The proposed TMDLs are for organophosphate pesticides (chlorpyrifos and diazinon), legacy pesticides (DDT, DDE, DDD, dieldrin, and toxaphene), and a priority organic compound (PCB). Table 1 lists the waterbody and pollutant combinations that these TMDLs address.

Table 1. Waterbody/Pollutant Combinations Requiring TMDLs

Waterbody Name	Current 303(d) List Pollutant(s)	Legacy Pesticides						PCB, Total	Chlorpyrifos	Diazinon
		p,p'-DDD	p,p'-DDE	p,p'-DDT	p,p'-DDT, Total	Dieldrin	Toxaphene			
Elkhorn Slough	Pesticides					X				
Moro Cojo Slough	Pesticides					X				
Moss Landing Harbor, North (Yacht Harbor)/Bennett Slough	Pesticides					X				
Moss Landing Harbor, South	Pesticides	X	X	X	X	X	X	X	X	
Old Salinas River Estuary	Pesticides					X	X		X	X
Tembladero Slough	Pesticides	X	X	X	X	X	X	X	X	X
Salinas Reclamation Canal, Lower	Pesticides, Priority Organics	X	X		X	X	X		X	X
Salinas Reclamation Canal, Upper/ Alisal Creek	Pesticides, Priority Organics				X	X	X	X		X
Espinosa Slough	Pesticides, Priority Organics					X			X	X
Salinas River Refuge Lagoon (South)	Pesticides									
Salinas River Lagoon (North)	Pesticides		X		X	X			X	X
Salinas River	Pesticides						X		X	X
Blanco Drain	Pesticides	X	X		X	X	X	X	X	X
Quail Creek	Not currently listed								X	X
Chualar Creek	Not currently listed								X	X
Total waterbody/pollutant combinations		4	5	2	6	11	7	4	10	10

Figures 1 and 2 (next pages) depict the legacy pesticide/priority organic watersheds and organophosphate pesticide watersheds, respectively, and characterize the project area.

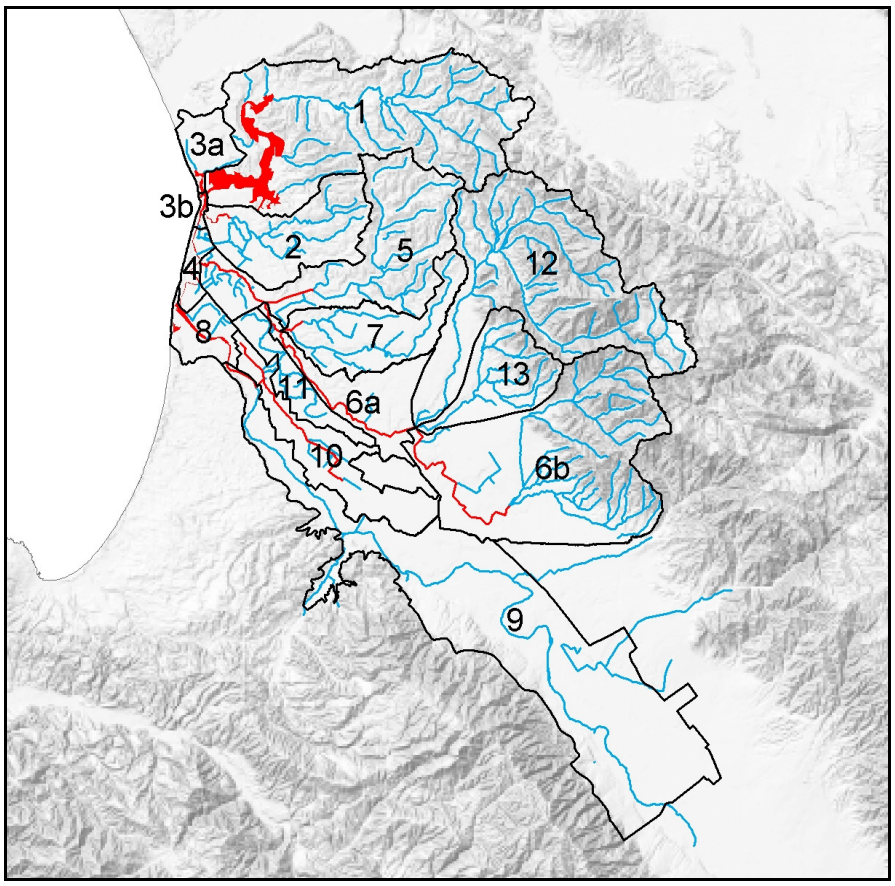

Figure 1. Legacy Pesticide/Priority Organic Watersheds. (Waterbodies impaired by legacy pesticides/priority organics shown in red. Refer to Tables 1 and 2 for comparison in grayscale)

Table 2. Legacy Pesticide/Priority Organic Watersheds

	Watershed	Area (Acres)
1	Elkhorn Slough	30,329
2	Moro Cojo Slough	9,731
3a	Moss Landing Harbor, North/Bennett Slough	2,798
3b	Moss Landing Harbor, South	273
4	Old Salinas River Estuary	1,463
5	Tembladero Slough	16,737
6a	Salinas Reclamation Canal, Lower	6,562
6b	Salinas Reclamation Canal, Upper/Alisal Creek	29,600
7	Espinosa Slough	8,645
8	Salinas River Lagoon, North	3,057
9	Salinas River	41,708
10	Blanco Drain	8,299
11	Alisal Slough Remnant (Rec Canal)	3,703
12	Gabilan Creek	27,713
13	Natividad Creek	7,404
	Total Acreage	198,022

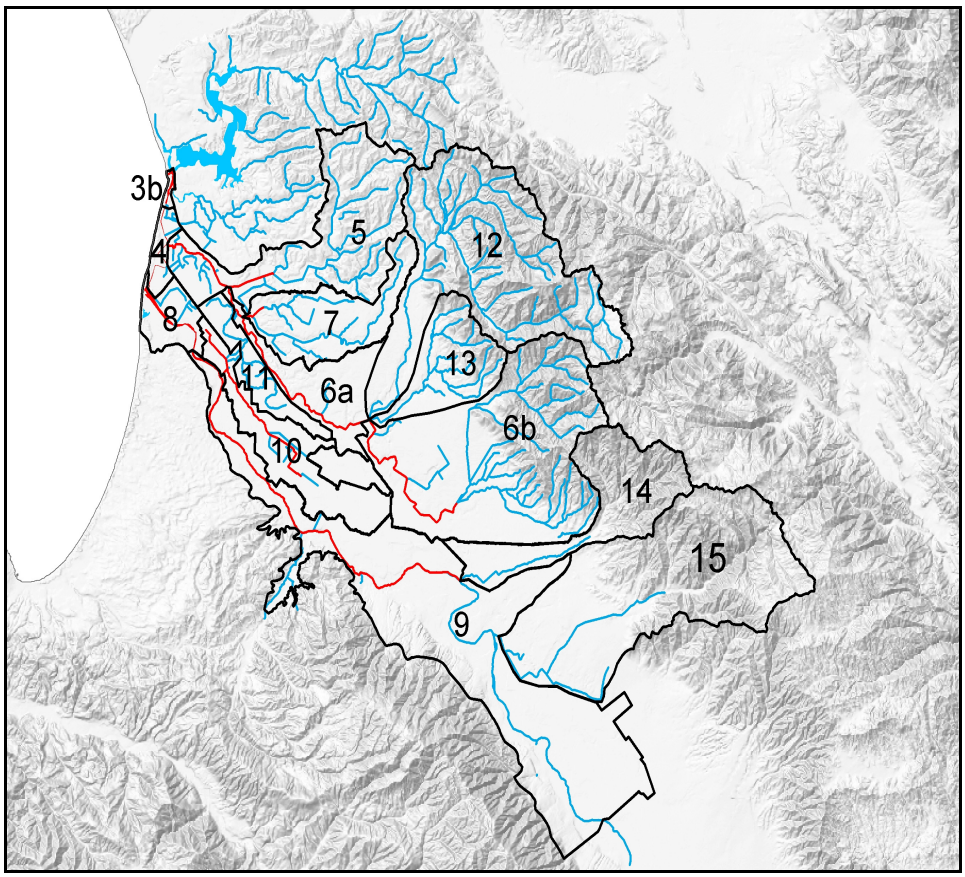

Figure 2. Watersheds impaired by organophosphate Pesticides. (Waterbodies impaired by organophosphate pesticides shown in red. Refer to Tables 1 and 3 for comparison in grayscale)

Table 3. Watersheds impaired by organophosphate Pesticides

Watershed Number	Watershed	Area (Acres)
3b	Moss Landing Harbor, South	273
4	Old Salinas River Estuary	1,463
5	Tembladero Slough	16,737
6a	Salinas Reclamation Canal, Lower	6,562
6b	Salinas Reclamation Canal, Upper/Alisal Creek	29,600
7	Espinosa Slough	8,645
8	Salinas River Lagoon, North	3,057
9	Salinas River	41,708
10	Blanco Drain	8,299
11	Alisal Slough Remnant (Rec Canal)	3,703
12	Gabilan Creek	27,713
13	Natividad Creek	7,404
14	Quail Creek	11,237
15	Chualar Creek	29,900
Total Acreage		196,301

Water Quality Objectives

The Central Coast Region's Water Quality Control Plan (Basin Plan) contains specific water quality objectives that apply to all inland surface waters, enclosed bays and estuaries and include values, wholly, or in part, for pesticides and priority organics. These include:

Toxicity

All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, toxicity bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board.

Survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality conditions, shall not be less than that for the same water body in areas unaffected by the waste discharge or, when necessary, for other control water that is consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater, latest edition. As a minimum, compliance with this objective shall be evaluated with a 96-hour bioassay.

In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances is encouraged.

Pesticides

No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life.

For waters where existing concentrations are presently nondetectable or where beneficial uses would be impaired by concentrations in excess of nondetectable levels, total identifiable chlorinated hydrocarbon pesticides shall not be present at concentrations detectable within the accuracy of analytical methods prescribed in Standard Methods for the Examination of Water and Wastewater, latest edition, or other equivalent methods approved by the Executive Officer.

Other Organics

Waters shall not contain organic substances in concentrations greater than the following:

Methylene Blue Activated Substances	0.2 mg/l
Phenols	0.1 mg/l
PCB's	**0.3 µg/l**
Phthalate Esters	0.002 µg/l

(Please note that the concentration for PCB's has been superseded by the California Toxics Rule that has water column criteria for the protection of aquatic life of 0.014 ppb (µg/L) and for the protection of human health for consumption of water and organisms of 0.00017 ppb (µg/L).

Organic Chemicals

All inland surface waters, enclosed bays, and estuaries shall not contain concentrations of organic chemicals in excess of the limiting concentrations set forth in California Code of Regulations, Title 22, Chapter 15, Article 5.5, Section 64444.5, Table 5 and listed in Table 3-1. (Please note that the reference to the California Code of Regulations and the values in Table 3-1 of the Basin Plan are outdated. The current (as of 09/14/2004) reference should read: California Code of Regulations, Title 22, Division 4, Chapter 15, Article 5.5, Section 64444, Table 64444-A.)

The reference to California Code of Regulations, Title 22 contains Maximum Contaminant Levels (MCLs) for water supplied to the public. The MCLs for the chemicals of concern in the Lower Salinas Valley/Elkhorn Slough Watershed are higher than the corresponding criteria in the protection of Human Health for the consumption of water and organisms in the California Toxics Rule, therefore staff applied the more stringent CTR criteria (see Table 4).

The following chemicals have CTR criteria but do not have corresponding MCLs: p,p'-DDD, p,p'-DDE, p,p'-DDT, and dieldrin. Chlorpyrifos and diazinon do not have CTR criteria or MCLs.

Table 4. Comparison of CTR Criteria and MCLs

Compound	CTR Criteria for Aquatic Life (ppb)	CTR Criteria for Human Health (ppb)	MCL (ppb)
Toxaphene	0.73	0.00073	3
PCBs	0.014	0.00017	0.5

Beneficial Uses

The designated beneficial uses for inland waters and coastal waters are identified in the Basin Plan for the listed waterbodies. These are shown in Tables 5 and 6.

Table 5. Basin-Plan designated Beneficial Uses for Inland Waters

Waterbody Names	MUN	AGR	PROC	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	RARE	EST	FRESH	COMM	SHELL
Moro Cojo Slough					X	X	X	X	X	X		X	X	X	X		X	X
Old Salinas River Estuary						X	X	X	X	X	X	X	X	X	X		X	X
Tembladero Slough						X	X	X		X		X		X	X		X	X
Espinosa Lake						X	X	X		X							X	
Espinosa Slough						X	X	X		X							X	
Salinas Reclamation Canal						X	X	X		X							X	
Alisal Creek	X	X			X	X	X	X	X	X		X					X	
Blanco Drain						X	X	X		X							X	
Salinas River Refuge Lagoon (South)						X	X	X	X	X	X		X	X			X	X
Salinas River Lagoon (North)						X	X	X	X	X	X	X	X	X	X		X	X
Salinas River, dnstr of Spreckels Gage	X	X					X	X	X	X	X					X	X	
Salinas River, Spreckels Gage-Chualar	X	X	X	X	X	X	X	X	X	X	X						X	
Salinas Riv, Chualar-Nacimiento Riv	X	X	X	X	X	X	X	X	X	X	X	X		X			X	

Note: Beneficial uses are regarded as existing whether the water body is perennial or ephemeral, or the flow is intermittent or continuous.

Table 6. Existing and Anticipated Uses of Elkhorn Slough and Moss Landing Harbor (Coastal Waters)

Coastal Water	REC-1	REC-2	IND	NAV	MAR	SHELL	COMM	RARE	WILD
Elkhorn Slough[a]	E	E			E	E	E	E	E
Moss Landing Harbor	E	E	E	E	E	E[b]	E	E	E

[a] Elkhorn Slough has been designated an ecological reserve by the California Department of Fish and Game, and recognized as a National Estuary Sanctuary by the Federal Government.

[b] Clamming is an existing beneficial use in the North Harbor and on the south side of the entrance channel to Elkhorn Slough (north of the Pacific Gas and Electric Cooling Water Intake). Presently, no shellfishing use occurs south of the Pacific Gas and Electric Intake.

NOTE: E = Existing beneficial water use.

Data Sources

Staff has evaluated data from the following sources:

1. Bay Protection and Toxic Clean-up Program – effects-based measurements of impacts in California's enclosed bays and estuaries. The BPTCP monitoring program sampled nearly 1,100 stations throughout the state between 1992 and 1997.
2. Toxic Substances Monitoring Program – a program administered by California's Department of Fish and Game since 1976. The program analyzes fish and other aquatic organisms from selected sampling stations for the detection and evaluation of the occurrence of toxic substances in fresh and estuarine waters of the state.
3. State Mussel Watch Program – a program run by California's Department of Fish and Game since 1976. The program analyzes resident and transplanted mussels and clams for trace elements, pesticides and PCBs.
4. Central Coast Ambient Monitoring Program – a program run by the Central Coast Water Board to monitor ambient water quality throughout the region. Water column, sediment and benthic macroinvertebrate data are collected on a five year rotation.
5. Reports/documents from numerous studies including:
    - Central Coast Watershed Studies (CCoWs). 2004a. Kozlowski D., F. Watson, M. Angelo, and J. Larson. March 2004. *Monitoring Chlorpyrifos and Diazinon in Impaired Surface Waters of the Lower Salinas Region*. Report to the California Department of Pesticide Regulation. WI-2004-03. The Watershed Institute, California State University – Monterey Bay. Seaside, CA. 170 pp.
    - Central Coast Watershed Studies (CCoWs). 2004b. Kozlowski D., F. Watson, M. Angelo, and S. Gilmore. March 2004. *Legacy Pesticide Sampling in Impaired Surface Waters of the Lower Salinas Region*. WI-2004-02. The Watershed Institute, California State University – Monterey Bay. Seaside, CA. 46 pp.
    - Anderson, B. S., Hunt, J. W., Phillips, B. M., Nicely, P. A., de Vlaming, V., Connor, V., Richard, N. and Tjeerdema, R.: 2003, *Ecotoxicologic impacts of agriculture drainwater in the Salinas River (California, USA*), Environ. Toxicol. Chem. 22, 2375–2384.
    - Hunt, John W., B. S. Anderson, B. M. Phillips, P. N. Nicely, R. S. Tjeerdema, H. M. Puckett, M. Stephenson, K. Worcester, V. De Vlaming. 2003. *Ambient Toxicity due to Chlorpyrifos and Diazinon in a Central California Coastal Watershed*. Environmental Monitoring and Assessment: 82: 83-112.
    - Johnson, B. November 2005. Diazinon and Pesticide-Related Toxicity in Bay Area Urban Creeks -- Water Quality Attainment Strategy and Total Maximum Daily Load (TMDL). California Regional Water Quality Control Board, San Francisco Bay Region (CRWQCB-SFBR). Proposed Basin Plan Amendment and Staff Report. San Francisco, CA.
    - Larry Walker Associates, 2005. *Calleguas Creek Watershed OC Pesticides and PCBs TMDL Technical Report*. Prepared for the Calleguas Creek Watershed Management Plan and submitted to the Los Angeles Regional Water Quality Control Board. Santa Monica, CA.
    - Worcester, K., D. Paradies, M. Adams, and D. Berman. July 2000. *Central Coast Ambient Monitoring Program -- Salinas River Watershed Characterization Report*. California Regional Water Quality Control Board, Central Coast Region (CRWQCB-CCR). Staff Report. San Luis Obispo, CA.
    - Wilen, C.A. 2001. Survey of residential pesticide use and sales in the San Diego Creek Watershed of Orange County, California. Report to the California Dept. Pesticide Regulation. 101pg. http://www.cdpr.ca.gov/docs/sw/contracts/sdcrk.pdf

Numeric Targets

Staff is proposing that the Lower Salinas River and Elkhorn Slough Pesticide and Priority Organic TMDLs contain water column and sediment numeric targets (Table 7), numeric targets for additive toxicity of diazinon and chlorpyrifos (Table 8), fish/shellfish tissue numeric targets for protection of human health (Table 9), and fish/shellfish numeric targets for protection of wildlife (Table 10).

Table 7. Water Column and Sediment Numeric Targets

CTR No. [A]	Compound	Human Health [B] *(ng/L)*	CCC [C] *(ng/L)*	CMC [D] *(ng/L)*	Sediment Target [E] *(µg/Kg)*	Water Type
108	4,4'-DDT	0.59	1.0	65	1.19	Saltwater
						Brackish [F]
				550		Freshwater
109	4,4'-DDE	0.59			2.2	Saltwater
					1.42	Brackish [F]
						Freshwater
110	4,4'-DDD	0.84			2.00	Saltwater
						Brackish [F]
					3.54	Freshwater
	Total DDT				3.89	Saltwater
						Brackish [F]
					6.98	Freshwater
111	Dieldrin	0.14	1.9	360	0.715	Saltwater
				240		Brackish [F]
			56		2.85	Freshwater
119-125	PCBs	0.17	30		22.7	Saltwater
			14			Brackish [F]
					34.1	Freshwater
126	Toxaphene	0.75	0.2	210	10	Saltwater
						Brackish [F]
				730		Freshwater
	Chlorpyrifos [G]		9	20		Saltwater
						Brackish [F]
			14			Freshwater
	Diazinon [G]		100	160		All Waters

Footnotes:
[A] California Toxics Rule promulgated by USEPA on May 18, 2000.
[B] 30-day average (based on 10^{-6} carcinogen risk – consumption of organisms only).
[C] CCC – Criterion Continuous Concentration [4-day (96-hour) average]. Not to be exceeded more than once in a three year period.
[D] CMC – Criterion Maximum Concentration [1- hour average]. Not to be exceeded more than once in a three year period.
[E] Sediment targets formed listing basis.
[F] Minimum of Freshwater and Saltwater Criteria.
[G] Numeric targets also developed for additive toxicity of chlorpyrifos and diazinon

Water column numeric targets are derived from California Toxics Rule (CTR) values for human health for DDT, dieldrin, PCBs and toxaphene. No water column target was derived for total DDT; however, achieving the numeric target for the individual congeners (4,4'-DDD, 4,4'-DDE, 4-4'-DDT) is expected to result in attainment of the bottom sediment targets for total DDT. For chlorpyrifos and diazinon, staff used the California Department of Fish and Game's *Water Quality Criteria for Diazinon and Chlorpyrifos.*

Diazinon criteria were modified based on the July 30, 2004 memorandum from California Department of Fish & Game (CDFG) to the Central Valley Regional Water Quality Control Board (Central Valley Water Board) that documents CDFG's reevaluation of their original work based on new information received by the Central Valley Water Board.

Saltwater sediment numeric targets are derived from either the Threshold Effects Level (TEL), the Effects Range - Low (ER-L), or the Upper Effects Threshold (UET) from NOAA Screening Quick Reference Tables (SQRT) (Buchman, 1999) for sediment.

Brackish water sediment numeric targets are derived from the maximum value of the brackish TEL (calculated as the minimum of the value between the saltwater TEL and freshwater TEL) and the saltwater ER-L value.

Freshwater sediment numeric targets are derived from the Threshold Effects Level (TEL) from NOAA SQRT (Buchman, 1999).

Sediment numeric target for toxaphene was derived from the New York State "Technical Guidance for Screening Contaminated Sediments (New York State, 1999, p. 24). The numeric target value is the lowest value given for sediment criteria.

Table 8. Numeric Target for additive toxicity of diazinon and chlorpyrifos

$$\frac{C_{Diazinon}}{O_{Diazinon}} + \frac{C_{Chlorpyrifos}}{O_{Chlorpyrifos}} = S;\ S \leq 1$$

Where:

C = the concentration of a pesticide measured in the receiving water.

O = the water quality objective or criterion for the specific beneficial use for each pesticide present, based on the best available information.

S = the sum; a sum exceeding one (1.0) indicates that beneficial uses may be adversely affected.

The numeric target for additive toxicity of diazinon and chlorpyrifos (Table 8 above) is derived from technical guidance developed by staff of the Central Valley Regional Water Quality Control Board (CVRWQCB) ("Policy for Application of Water Quality Objectives" and policy on "Pesticide Discharges from Nonpoint Sources"). This numeric target recognizes that diazinon and chlorpyrifos have the same mechanism of toxic action, and have been shown to exhibit additive toxicity to aquatic invertebrates when they co-occur.

Table 9. Fish/Shellfish Tissue Numeric Targets for Protection of Human Health (ppb, fish fillet or whole shellfish wet weight)

Analyte	Numeric Target
DDT, Total[A]	100
Dieldrin	2
PCB, Total[B]	20
Toxaphene	30
Chlorpyrifos	1,200
Diazinon	300

[A] Sum of 4,4'- and 2,4'-isomers of DDT, DDE, DDD
[B] Sum of Aroclors 1248, 1254 and 1260

Fish and shellfish tissue numeric targets for protection of human health are derived from the minimum value of: 1) California Office of Environmental Health Hazard Assessment Tissue Screening Values from the California Lakes Study; 2) United States Environmental Protection Agency Recommended Screening Values for Recreational Fishers; or, 3) United States Food and Drug Administration Action and Tolerance Levels.

Table 10. Fish/Shellfish Tissue Numeric Targets for Protection of Wildlife (ug/kg whole fish/shellfish wet weight)

Compound	Numeric Target
DDT, Total	1000
Dieldrin	100
PCB, Total of congeners	500
Toxaphene	100

Fish and shellfish tissue numeric targets for protection of wildlife are derived from National Academy of Science Fish Tissue Guidelines.

Sources

Staff has identified potential sources and relative source classifications that are most likely to contribute to impairment of the listed waterbodies:

- Irrigated agricultural discharges,
- storm drain discharges to municipally owned and operated storm sewer systems (MS4s) required to be covered by an NPDES permit,
- storm water discharges from construction activities required to be covered by and NPDES permit;
- Point source discharges.

Total Maximum Daily Load

Staff proposes to express the TMDLs as concentration-based loads equal to the water column numeric targets listed Table 7 above, including the additive toxicity of diazinon and chlorpyrifos (Table 8).

Allocations

Although load and waste load allocations have yet to be developed, the following is a potential allocation scenario:

- Waste Load Allocations assigned to point source discharges will be equal to the Total Maximum Daily Loads.
- Load Allocations assigned to nonpoint sources will be equal to the Total Maximum Daily Loads.
- Because we are proposing concentration-based TMDLs, allocations should be the same for each source and responsible party.

Implementation Alternatives

Staff has identified numerous alternative methods of compliance available for controlling pesticides and priority organic compounds in the Lower Salinas River and Elkhorn Slough watersheds. The proposed project will require control of legacy pesticides DDT, DDD, DDE, dieldrin, and toxaphene; control of a priority organic compound PCB; as well as control of currently registered pesticides diazinon and chlorpyrifos.

Legacy pesticides and PCBs possess physical and chemical properties that influence their persistence, fate, and transport in the environment. Legacy pesticides and PCBs resist degradation, associate with sediments or other solids, and accumulate in the tissue of invertebrates, fish and mammals. Sediment transport is the principal mechanism of legacy pesticides and PCB movement in the Lower Salinas River and Elkhorn Slough watersheds. Therefore, the project relies to a large extent on the implementation of effective best management practices (BMPs) to manage the discharge of sediment, particularly fine sediments, given that the principal pathway of legacy pesticides and PCB transport in the watershed is the movement of fine soil particles to which these compounds tend to adsorb. The majority of legacy pesticides and PCBs are discharged into waterbodies via stormwater runoff from irrigated agricultural lands, urban lands, and from construction activities. Attainment of the allocations could be achieved through discharger implementation of structural and nonstructural control strategies designed to reduce sediment loading from agricultural and urban land uses and from construction activities.

Diazinon and chlorpyrifos are currently used in agricultural practices within the Lower Salinas Valley and Elkhorn Slough watersheds. The implementation plan for this project could rely upon agricultural BMPs to control both stormwater runoff and irrigation return flows. In 2001 the United States Environmental Protection Agency began to phase-out the non-agricultural (residential) use of diazinon and chlorpyrifos; however, urban lands contribute a small portion of loading from landscape maintenance activities, structural pest control and unreported residential use. The implementation plan for this project could rely upon urban storm water BMPs to attain allocations. Attainment of the allocations could be achieved through discharger implementation of structural and nonstructural control strategies designed to reduce stormwater and irrigation return water loading from agricultural activities and stormwater loading from urban lands.

Structural and non-structural control strategies can be based on specific land uses, sources, or periods of a storm event, and are described in general below. Nonstructural BMPs are generally designed to control or eliminate the sources of pollutants to a watershed. Structural BMPs include source control as well as treatment control BMPs designed to remove pollutants from runoff. The examples below are general, (not specific to Lower Salinas Valley and Elkhorn Slough watersheds), and are not meant to be exhaustive of the all possible or appropriate BMPs.

Nonstructural Controls

- **Waste Management Facilities**: Develop, implement and inform the public about a collection system program for all banned organochlorine pesticides, PCBs, diazinon and chlorpyrifos.
- **Education and Outreach**: Review and refine the educational/outreach programs that have already been instituted by the construction industry, agriculture, and MS4 permittees/stormwater management agencies in response to existing permit and/or TMDL requirements. Education and outreach facilitates the understanding and implementation of appropriate erosion/sediment control practices to prevent offsite migration of sediment and associated pollutants.
- **Road and Street Maintenance**: Increase the frequency of street sweeping to maintain clean sidewalks, streets, and gutters. A reduction in sediment load may lead to a reduction in pesticides and PCBs being carried to the MS4s, and ultimately to Lower Salinas River Valley and Elkhorn Slough watershed waters, since sediment has been found to adsorb these compounds.
- **Illicit Discharges**: Identify and eliminate illicit discharges to the storm drain system.
- **Inspections**: Conduct inspections of commercial and industrial facilities for compliance with local ordinances and permits, as well as pesticide and priority organic compound load reductions required under these TMDLs. Conduct inspections of treatment control BMPs to ensure their adequacy of design and proper function.
- **Training**: BMP programs to prevent or reduce erosion and offsite migration of sediment are being implemented by dischargers in response to existing permits and/or TMDL requirements. Focused training on the implementation of these BMPs and/or BMPs enhanced to address fine particulates could improve BMP efficacy and reduce the transport to surface waters of sediment and associated pollutants.
- **Water Conservation**: Practices and programs that limit the amount of sheet water runoff through irrigation controls could effectively reduces the amount of sediment and associated pollutants to surface waters. Such programs could include “intelligent” irrigation systems operated according to climatic needs.
- **Development/Enforcement of Local Ordinances**: Develop and enforce municipal ordinances prohibiting exposure of pesticides and priority organic compounds to stormwater and stormwater drainage pathways, or eliminating dry weather nuisance flows.

Structural Controls

- **Vegetated Swales and Buffer Strips**: Construct and maintain vegetative buffers and swales along roadsides and in medians. The replacement of open soil or concreted curb or slope areas with vegetated cover would slow down the runoff velocity, increase stormwater infiltration and could reduce the loading of potentially contaminated fine sediments to surface waters.
- **Natural Treatment Systems**: The construction and use of natural or artificially created wetland systems would likely retard and/or retain sediments, including the fine particulates to which the pesticides and PCBs adhere.
- **Silt Fences/Straw Bales**: These are controls placed in construction areas to control sediment. They are generally temporary measures designed to intercept and slow the flow of sediment-laden sheet flow runoff. Silt fences are comprised of permeable fabric that allows sediment in runoff to settle, which should also help control particulates before water leaves the construction site. Straw bales require lengthy installation. Both types of BMPs are primarily placed along and down slope of exposed, highly erodible areas.
- **Stormdrain Filters/Inlet Protection**: The discharge of sediment into drainages can be reduced by covering or protecting inlets to stormdrains, and/or using filters within stormdrains. The inlet protectors allow sediment laden runoff from construction or other types of activities to be detained and/or filtered to filter to allow sediment to settle and be removed prior to discharge into storm drainage systems or watercourses.

- **Detention Basins**: **Detention Basins/Retention Ponds**: Stormwater flows can be effectively retained through these systems. They also reduce the overall levels of sediment-laden runoff flowing into adjacent waterbodies.
- **Soil Stabilization:** Various soil stabilization measures, including mulches, binders, and hydroseeding can be effective erosion control measures. They can increase cover, stabilize disturbed soil areas, or protect soils from erosion by wind or water, but are temporary in nature, and more or less reliable to retain the original soil cover depending upon how they are applied and maintained.
- **Diversion Systems**: Construct diversion systems to capture sediment and non-stormwater runoff. During low flow conditions, runoff may be diverted from storm drain outlets to an on-site detention or treatment system and released back to the creek, or it may be diverted to wastewater collection plants for treatment.
- **Infiltration Systems**: Install and maintain pavement systems that allow storm water to infiltrate into the ground rather than flow into surface waters, potentially carrying sediment and associated pollutants.
- **Dredging:** Under extreme storm conditions, BMPs may not be effective in reducing erosion and the transport of sediments that may contain pesticides and PCB compounds and/or other pollutants. In such cases, it may be necessary to physically remove, or sequester (e.g., by capping), accumulated sediments and associated pollutants.

Monitoring

The Monitoring Plan (to be developed) will outline:

- Monitoring sites.
- Frequency of monitoring.
- Parties responsible for monitoring.

Progress Review

Water Board staff will evaluate implementation progress every three years.

Additional Requirements

Additional requirements will be considered in implementation if management practices do not result in achievement of water quality objectives.

Timeline

We anticipate that the TMDL should be achieved 40 years from the date of TMDL approval.

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